# Protective Clothing Based on Permselective Membrane and Carbon Adsorption

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## Abstract

The goal of this project is to develop chemical protective clothing for use by DOE decontamination and decommissioning workers that will increase worker productivity—because it is cooler and more comfortable than conventional protective clothing—while maintaining protection against chemical liquids and vapors.

This poster describes the results from Phase I of a two-phase project to complete development of the fabric and to demonstrate its utility in field trials at DOE sites. The fabric is based on a permselective membrane that is freely permeable to water but essentially permeable to toxic organic vapors. In the first phase, the fabric properties were improved by modifying both the materials and the preparation procedure used to form the membrane. Production of the fabric was then scaled up to use commercial-scale production machinery. A small number of prototype suits were made, and a preliminary suit evaluation was conducted.

The fabrics produced during this project were a significant advancement in state-of-the-art protective fabrics. No currently available fabrics combine protection against vapor and liquid chemical hazards while reducing the potential for heat stress by allowing water vapor to permeate the fabric. The fabrics developed in this project meet the water transmission rate goals (greater than 800 $g/m^2 \cdot day$) and provide chemical protection equivalent to currently used non-water-permeable chemical protective suits. These results were achieved in a practical fabric that is strong, durable, flexible, lightweight, and easy to manufacture into a suit. A cost benefit calcuation based on the improvement in worker productivity achieved with MTR water-vapor-permeable suits over a conventional occlusive suit shows that the MTR suits are cost effective if used for two days or more. However, small and achievable improvements in the fabric properties and reductions in production as the process is scaled up would make MTR's water-permeable suits cost effective even when exchanged daily.

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